TO: Tad Johnsen, Water and Light Director

From: John Betz, Committee Chair, Source Water Protection Plan Task Force

Date: March1, 2012

Re: Task Force Update Report

At the February meeting of the Columbia Source Water Protection Task Force, the group approved a first-draft of a source water protection plan for the City of Columbia. Each member of the task force is now working on changes to or improvement of the final plan. Please find attached a copy of the draft source water plan. The task force will prioritize in order of importance the scheduling of each item in the management planning section of the plan. The final draft of the plan will then be submitted to the advisory board for their comments. An item of discussion during the March meeting concerned the importance of resuming testing for chloride in the McBaine wells.

Source Water Protection Plan

City of Columbia Missouri

Prepared By:

Columbia Source Water Protection Task Force

With Assistance From:

Missouri Department of Natural Resources

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Purposes and Objectives of the Plan

This plan is to be used to provide education and information to the Columbia Water & Light Department, the City of Columbia and the surrounding community. Protection of public health is the foremost objective of the City of Columbia Source Water Protection Program. Protecting the environment and the infrastructure of the utilities that serve this community are important objectives that are necessary to help sustain and enhance the health and welfare of the community. The information within this plan can help to identify risks, needs, and actions for our community and the public drinking water system. This plan can guide us through a process that will enable us to become better informed and educated for the purpose of protecting the environment. This will ultimately have a positive and long term effect on the water resources that become our drinking water.

ACKNOWLEDGEMENTS

This plan is evidence of a cooperative effort between the City of Columbia and the Missouri Department of Natural Resources.

City of Columbia, Missouri

PWIS # 3010181

INTRODUCTION

Purpose and Scope

The purpose of this guide is to assist in the assessment of the drinking water sources for the City of Columbia. This guide is an overview of the Water & Light Department's source water and water treatment plant operation.

System and Source Overview

The Columbia Water Treatment Plant is owned and operated by the City of Columbia and the Water & Light Department. The system supplies water to approximately _____ Customers. The water system has about _____service connections and the average daily consumption is _____ million gallons per day. The Columbia Water Treatment Plant is in compliance with all state and federal drinking water regulations. The plant is in the Macon Region of the Missouri Department of Natural Resources.

The service territory of the Columbia Water Treatment Plant lies in Boone County, including the City of Columbia, where the majority of the customers reside. Through cooperative service connections, water is sold to the following Public Water Districts and customers: _____. The area's economy is _____. The area is served directly by Interstate 70 and U. S. Highway 63.

Columbia's first community water supply was derived from a small surface reservoir on a dammed section of the Hinkson Creek. In 1903, Columbia voters, motivated by public health concerns, voted by a margin of 2 to 1 in favor of an alternate deep well water supply. Following voter approval of the purchase of the Columbia Water and Light Plant in 1904, a series of 1,200-feet deep wells yielding water of exceptionally high quality were constructed. By 1947, a one-million-gallon water tower was put into service. In 1960, Guyton and Associates projected that continued withdrawals of up to 8 mgd from the deep wells would lower water levels to the top of the Roubidoux formation (700 ft. below ground surface).

In the summer of 1968, Layne-Western Company, Inc. of Kansas City, Missouri undertook a study (Nuzman, 1969) to assess the potential of the "McBaine Bottoms," a 14- square-mile alluvial flood plain adjacent to the Missouri River extending from Huntsdale to Easley, as an alternate water source for the City of Columbia.

The alluvial fill of the Missouri River limestone erosional channel was found to be 100 feet deep to the limestone bedrock formation. 5ince the fill consisted of porous materials, such as silts, sands and gravel, "excellent communication" existed between the Missouri River and the aquifer in this area. Overall, the aquifer was expected to yield several times more than the 24 mgd (year 2000) projected future water use. As a result, the original planning for the well field called for 12 wells with a capacity of 2.5 mgd each for a total yield of 30 mgd.

Minimal household water use was found within the alluvial flood plain. Where such use occurred, there were complaints related to iron, including discoloration and taste. However, an alternate public water supply district source was available for domestic use.

Columbia's water treatment plant and well water source is located ten miles south of the MU football stadium on Route K, near the small town of McBaine. The water-bearing stratum from which the City draws its water is often denoted as the "McBaine Aquifer." The plant is about one-and-a-half miles from the Missouri River.

Water is drawn by wells from a formation called an "alluvial aquifer." The aquifer is composed of silt, clay, coarse-grained sand, and gravel. All of this rests on top of limestone bedrock. The ten-square-mile area in the McBaine Bottoms holds an estimated 5 billion gallons of water. Columbia uses around 6 billion gallons of water each year. The limestone formation is high in water hardness and alkalinity. Average hardness averages 340 mg/L (parts per million), a water hardness much too high to pump to Columbia's population. The water from this limestone formation is also high in carbon dioxide and dissolved iron. Other than hardness, carbon dioxide and iron, the quality in general is extremely high. Very little additional treatment has ever been necessary.

The ground water moves slowly (on average less than a couple of inches a day) through the sand and gravel aquifer. The flow of the aquifer water historically parallels the flow of the Missouri river. Water use from the aquifer is replenished by Missouri river water, precipitation, and flow from higher elevations.

The water treatment plant operation has fifteen "shallow wells" in the McBaine bottoms. These wells are situated on seven sites that are separated by a minimum of 2,500 feet to reduce the possibility of wells competing for the same water area. These wells average 95 feet in depth (65 feet of well column and 30 feet of stainless steel screen). Each of these wells when new is capable of pumping about 2 million gallons of water per day. Each well has its own

individual water meter. Information on pump drawdown is taken each month to assess the operational condition of each well. This allows the W&L to determine well capacity. The water is pumped from these wells to the treatment plant.

Columbia's plant is a lime softening, iron removal plant. Hard water contributes to scale in water lines and hot water heaters. Iron, when it comes out of solution, causes serious staining problems in clothing and sinks. Water from the well field is first run through aerators to allow removal of CO2 and to oxidize the iron. Slaked lime is added to the well water in four primary treatment basins to reduce the hardness from 340 parts per million to 150 parts per million. This level of hardness is considered by professionals to be a level of moderate hardness for a public water supply.

The softened water is then allowed to flow through filter beds of anthracite and sand to remove suspended particles of lime and other turbidity. Chlorine and ammonium sulfate are added to the water before it is pumped to Columbia. This process produces something called a combined chlorine residual. This chlorine stays in the finished water as a residual, in the event that some sort of contamination makes its way into the distribution system. Columbia only in recent years began adding ammonium sulfate along with the chlorine. This was done to reduce the levels of trihalomethane formation in the distribution system.

After its treatment at the McBaine plant, the finished water is pumped to three holding reservoirs in the City. A series of pumps in each of these pumping stations then sends the water out into the distribution system.

The "great Missouri River floods" of 1993 and 1995 demonstrated that the plant and wells were in highly vulnerable area. After these floods, well platforms were raised seven feet, a concrete wall was constructed around the treatment plant, and secondary power and waterlines were run from the well field to the plant.

Seven of the City of Columbia's original deep wells are still listed by DNR as part of the City's water system. Most of these wells have been inactive for decades. Although many of them are operationally non-functional, several are identified by DNR as emergency backup sources.

The old wells are deep (900-1,500') with 400-750' casings. The wellheads are fully enclosed in brick buildings. In two preliminary tours of the sites, the threats and risks to these wells appear to be minimal.

Deep wells 8 and 10 have been renovated and brought back into service as aquifer storage and recovery wells. Well 7 at the West Ash Pumping Station and well 5 at the northeast booster station are candidate sites for future aquifer and storage wells.

The Crump, El Ray, and Prathersville wells were taken over by W&L in the 1990s. Like the majority of the remaining old deep wells, these old water district operations are not a source of supply for the city. The Crump well is operational.

Implementation Strategy

The Columbia Source Water Task Force will meet with local officials, business owners, and the citizens of the Columbia community to provide information about the actions they may take to protect the source water area. Specific action items are discussed in Step # 5, Management Planning and Education.

STEP 1 - Planning Team

This task force has been organized to help compile site specific information for the Columbia Source Water Protection Plan Report. The task force will meet on an annual basis to review and update the SWPP.

The planning team consists of:

John Betz	Council Appointee
Tom O'Connor	H20'C Engineers
Josh Lehmen	Council Appointee
Ben Ross	Council Appointee
Steve Lauzier	Council Appointee
Floyd Turner	Water & Light Department
Tim James	Department of Conservation
Roger Ballew	Public Water District #9

Vic Bogosian	Eagle Bluff's Conservation Area
Tod Houts	University of Missouri
David Storvick	Water & Light Department
David Sorrell	Public Works Department
Tomas Zajicek	Water & Light Department

Step 2 – Delineation

The City of Columbia has adopted the 20 year time of travel line in the McBaine River Bottoms that was used by the Department of Natural Resources in their original delineation. This area is located on the eastern side of the Missouri River and is bordered by the town of Huntsdale to the northwest and the Department of Conversation's Eagle Bluff's wetlands on the Southeast. This delineation may change with an updated and improved delineation or by advisement from the Missouri Department of Natural Resources.

This delineation zone around the respective well field was chosen by the planning team to provide an area that is manageable in protecting Columbia's water supply. The area of delineation will be marked on a map at the 20 year time of travel line around the fifteen McBaine aquifer wells.

Step 3 – Inventory

Inventory was conducted by the Columbia Source Water Protection Task Force. The Task Force used as an information source the Missouri Department of Natural Resources' Public Drinking Water Program's databases via the University of Missouri CARES system. Information was also collected by searching local records, historical land use data, and on-site verification.

This inventory of potential contaminant risks helped to identify not only potential for contamination to the immediate area but also the most likely risk in some cases. It is important to identify large as well as small quantities of these contaminants. With this contaminant inventory, the Task Force was able to visualize, assess, and prioritize potential risk locations. Contaminants are materials that could potentially contaminate the source water by themselves or in combination with other substances. Contaminant inventories include but are not limited to: fuel and oils, pesticides, nutrients, synthetic organic chemicals, volatile organic chemicals,

animal or human waste, etc. Owner-operators of these contaminant inventories should be reminded of their responsibilities by law (where applicable), and their ethical business practices to provide responsible storage, use, and disposal of their product(s).

Source Water Protection Areas (SWPAs) fall into two broad categories: the older in-town deep wells, and the McBaine Bottoms wells that are the actual source for Columbia's water supply.

Old Deep Wells

With regard to the old, non-operatonal in-town wells, the potential threats are mostly those outlined in the DNR's Contaminant Data Sheets. These potential contaminant sources tend to be small businesses such as gas stations or retailers, who may stock chemicals such as pesticides, oil, gasoline, and cleaners.

The old deep wells include well #1, located on the west side of the City power plant; well #2, located in the basement of the power plant; well #S, located near Oakland Gravel Road; well # 6, near East Boulevard; well #7, located on the site of the West Ash pumping Station; Oakview well. Non-operational wells also include the Crump well, Harvester well, and the Brown School road well.

Well #4 at the City power plant is used to supply two ground storage reservoirs with water that is used for power plant cooling operations. The well and the storage reservoirs are not connected to the distribution system.

Overall, the old deep wells do not appear to be susceptible to contamination. They are very deep (900' – 1500'), are cased to between 400' and 700', and the wellheads are fully enclosed in brick buildings.

Despite being inactive, these wells have value and potential future uses as aquifer storage and recovery wells, emergency water supply wells, irrigation/non-potable use functionality, or assets to be sold.

Weighing the miniscule risks against the possibilities for future use, it does not appear that there are significant, compelling reasons to plug or abandon the in-town wells.

The old Prathersville elevated tank and El Ray tower have been disconnected and abandoned. These inactive storage facilities should be continuously maintained or removed.

Spill Response

The staff of the Water & Light Department will contact the appropriate authorities listed in the Emergency Operations Plan – Step 6, and in Appendix 3 of any contaminant spill or inventory loss within the SWPA indicated on the provided map, or any such loss or spill of contaminant in an area which may be of concern. The spill response procedure identified in the Emergency Action Plan will be used as a guide by the Columbia Water & Light Department staff in the event of a spill.

Security

The Columbia Water Treatment Plant will continue to operate its continuous security surveillance of the facility as well as the monitoring of source water to safeguard against contamination. This facility will continue to maintain the secured high fences and locked gates.

Conservation as Source Water Protection

The many valuable benefits of source water protection are readily apparent to those in the water supply industry. Effective source water protection efforts can greatly reduce treatment costs while protecting public health and natural resources.

While many threats to our source water are readily apparent, some are less so. For example, even our own withdrawals for purpose of water supply pose a potential threat to our source waters. If our withdrawals exceed the rate at which our reservoirs or ground waters are replenished, we run the risk of depleting our supplies. If, subsequently, we are forced to dig more or deeper wells, we increase both capital costs and pumping costs. If we pump a well harder and more often, we tend to increase the size of the area of influence around the well.

Particularly with wells that are shallow, alluvial, or otherwise vulnerable, increased pumping has the potential to introduce additional contaminants to our water, resulting in increased risk and/or treatment costs.

Due to this linkage between withdrawal quantity and source water quality, conservation is, in itself, a form of source water protection.

In the strictest sense, the ground water in the McBaine bottoms is our true source water. Potential threats to this water include:

1. Malicious tampering with individual supply wells (or nearby monitoring wells)
2. Use of pesticides, herbicides, and fertilizers
3. Leakage from the City of Columbia wastewater treatment wetlands
4. Groundwater migration from under the Eagle Bluffs conservation wetlands
5. Infiltration from the Missouri River

These threats could be addressed by:

1. Fencing/access control around supply wells; signage indicating possible fines for tampering
2. County ordinances regarding chemical application
3. Diligent inspection/maintenance of wetland cells; testing of nearby monitoring wells
4. Modification of wetlands operational protocols
5. Conservation; minimizing use of the wells nearest the river

Step 4 – Susceptibility Determination

Missouri Department of Natural Resources Cares Maps, well data sheets, and contaminant inventory data were used by the Columbia Source Water Protection Task Force to make susceptibility determinations.

Step 5 – Management Planning

The Task Force has developed the following action items to establish an effective wellhead protection program for both the McBaine River Bottoms and the aquifers supplying the old City deep wells and acquired water district sites. These items will help to prevent, reduce, or eliminate contamination potential in the City's two water sources.

1. The Task Force, along with the Columbia Water & Light Department staff, will provide a plan of action for all the old deep wells referenced in the Section 3 of this report. The plan of action will examine the possibility of renovating at least two of the old deep wells for use as additional aquifer and storage wells. Consideration will also be given to the possibility of well renovation and water use for non-drinking purposes such as irrigation and street washing. To be completed by the end of 2012.

2. A decision will be made about the future plans for the Crump well, Oakview well, Harvester Well, and Brown Station School Road well. To be completed in 2012.

3. The Task Force's Source Water Protection Plan will include plans for the capping, plugging, removal, or renovation of all wells referenced in items number 1 and 2 above. To be completed by the end of 2012.

4. The Task Force will assist W&L staff in assuring that old deep well #4 at the City power plant and the two storage reservoirs meet all Department of Natural standards for source water protection, even though the operation is not connected to the City's water distribution system. To be completed in 2012.

5. The Task Force will submit the Source Water Protection Plan to the Missouri Department of Natural Resources for their endorsement. To be completed in early 2012.

6. The Task Force will present the approved Source Water Protection Plan to the Columbia City Council. To be completed in 2012.

7. The Task Force will present the approved SWPP to the Boone County Local Emergency Planning Committees. To be done in 2012.

8. The Task Force and the Water & Light Department will develop a program that deals with fencing/access control around supply wells; signage indicating possible fines for tampering; County ordinances regarding chemical application; diligent maintenance and inspection of wetland cells; testing of nearby monitoring wells; and modification of City wetlands operation protocols. Plans to be developed by the end of 2012.

9. The Task Force and the Water & Light Department will post informational signs at the borders of the wellhead protection area in McBaine , at the two aquifer-storage and recovery wells, at all the old deep well sites, and old water district sites. To be completed in 2012.

10. The Task Force encourages the Water & Light Department's staff at a minimum to sample all McBaine Bottom wells for chloride and total coliforms on a monthly basis. To be completed in 2012.

11. The Task Force will contact the Southern Star Central Gas Pipe Line Company and the Magellan Pipeline Company to ensure they understand the importance of source water protection in the McBaine bottoms. The natural gas and fuel lines in the well field present a minimum threat to the aquifer, but it is important that the two companies understand the need of emergency response procedures in the event of such an accident.

12. The Task Force will arrange for the mailing of source water protection information to businesses located in the Missouri Department of Natural Resource's delineation areas for the Columbia water operation. Business operations include garages, auto and truck dealers, chemical storage areas, shopping malls, chemical sales dealers, and funeral homes. To be completed in 2012.

13. The Task Force will provide source water protection information for farmers in the McBaine Bottoms and will encourage them to work with the City of Columbia in protecting the quality of our water. On-going

14. The Task Force will continue to encourage neighboring water districts and other water providers in the City of Columbia to develop a regional source water protection plan. On-going

15. The Task Force will examine already existing ordinances and regulations governing operations and businesses that have the potential to contaminate aquifers and make decisions about the need for additional rules and guidelines. To be completed in 2012.

16. The Task Force will arrange for the mailing of an informational source water protection brochure, via a bill insert, to all City of Columbia customers. To be completed in 2012.

17. The Task Force will pursue an opportunity to educate children on the importance of source water protection. The Task Force will offer to assist the Missouri Department of Natural Resources and organizations such as the Missouri Water and Wastewater Conference, the Mo. Section American Water Works Association, and the Missouri Rural Water Association in any education projects these groups might be planning for community education. To be completed in 2012.

18. The Task Force will develop public education material and PowerPoint presentations on the importance of source water protection. To be completed in 2012.

19. The SWPP will be updated annually by the Task Force and made available to the Missouri Department of Natural Resources every four years or as necessary.

Public Education

The Task Force may, in conjunction with local schools and interested public or professional citizens, provide for an informational and educational opportunity by supplying this Source Water Protection Plan for their review and suggestions. Such opportunities may include annual field days to the McBaine River Bottoms, pumping stations, aquifer storage and recovery wells, and old deep well sites. Other possible opportunities to assist the SWP Task Force may include

school presentations, poster contests, newspaper articles, Consumer Confidence Reports, festivals, or other informational opportunities.

This Source Water Protection Plan will be made available to the public at the Water & Light Administrative Office. It will be presented to any new business or industry, or any new location of potential contaminant sources within the delineation area.

Step 6 – Columbia Water & Light Department Emergency Operations Plan

The Columbia W&L's emergency plan for the Water Treatment Plant is designed to assist in the first hours and days after a major disaster has damaged or destroyed the water supply and system. This plan provides a checklist to remind employees of the many tasks and decisions that they will be faced with in an emergency situation. The procedures will provide critical information that will help staff in the event of an emergency. For security reasons, the EOP will be made available on an as-needed basis to external agencies and is not included as part of this document.

The contents of the EOP may not be inclusive of all necessary information needed for individual utilities. Continual planning and training will provide for the most effective EOP. Additional emergency notification information is included in Appendix 3.

Recommendations

The Columbia Source Water Protection Task Force encourages City of Columbia and Water & Light Department employees and administrators, council members, and the public to become involved with efforts directed toward sustainability of our water utility. There are fundamental solutions to a healthy and viable utility. Source Water Protection is the most cost effective way to help guarantee safe and affordable drinking water for future generations. The only way to achieve the purpose and objectives of this Source Water Protection Program will be to exercise the actions and goals identified in this plan. Continual education and research are necessary to become better informed. Providing education and motivation for other systems personnel and utility stakeholders such as customers, business and industry owners, and interested community leaders, can lead to a successful Source Water Protection Program.

Columbia Source Water Protection Program Task Force Signature Page

The Task Force members contributed to the compilation of this document and are committed to the implementation of a source water protection plan for protection of the groundwater resources that serve as the source water for the public drinking water supply for Columbia, Missouri.

Signed:

John Betz _____

Chair, SWP Task Force

Floyd Turner _____

W&L Department

Tom O'Connor _____

Vice Chair, SWP Task Force

Josh Lehmen _____

Council Appointee

Ben Ross _____

Council Appointee

Steve Lauzier _____

Council Appointee

Tim James _____

Department of Conservation

Roger Ballew _____

Public Water District #9

Vic Bogasian _____

Eagle Bluff's Conservation Area

Tod Houts _____

University of Missouri

David Storvick _____

W&L Department

David Sorrell _____

Public Works Department

Tomas Zajicek _____

W&L Department

APPENDIX 3

Emergency Response/Spills Information

Environmental Spills: Contact #s

Missouri Dept. of Natural Resources (MDNR)	
Environmental Emergency Response 24 hr. Spill Line:	573-634-2436
National Response Center Spill Line:	800-424-8802
Boone County Emergency Management:	573-
U.S. EPA Region VII:	913-281-0991
MDNR Northeast Regional Office:	660-385-800
MDNR Public Drinking Water:	573-751-5331